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‘Daily Drags’ and ‘Wannabe Walkers’ – Identifying dissatisfied public transport users who might travel more actively and sustainably

Author(s):     Gustav Bösehans <sup>a,\*</sup>

Ian Walker <sup>a</sup>

<sup>a</sup> *Department of Psychology, University of Bath, BA2 7AY, UK*

**Abstract.** This paper sought better to understand the motives and experiences of bus users, with a view to identifying subgroups who might be persuaded to use healthier and more sustainable modes. Student and staff bus users of a middle-sized university in the UK participated in an online survey, indicating their agreement with a series of statements about local bus services. These statements were combined into independent factors using principal component analysis. Then, using cluster analysis, respondents were split into different types of bus users. The analysis suggested six distinct types, four of which broadly support the captive versus choice user distinction made in earlier studies and two of which were novel. The findings are discussed in relation to previous research and implications for public transport operators and promoters of active travel are outlined. Specifically, the current research suggests that two subgroups of bus users, together accounting for around 41% of this sample, may quite easily be persuaded to travel actively; the other groups, more committed to buses, might have their journeys improved if public transport operators address their concerns. Future research may address the generalizability of the proposed cluster solution and test its applicability in applied settings.

**Keywords:** active travel, commuting, public transport, segmentation, sustainable transport, travel behaviour

\* Corresponding author.

*E-mail address:* g.bosehans@bath.ac.uk (G. Bösehans)

*Postal address:* Department of Psychology, Office 5S, University of Bath, BA2 7AY, UK

## 1. Introduction

For years, research on transport-mode change has focused on car drivers, looking at their motives for car use (e.g. Mann & Abraham, 2006; Lois & López-Sáez, 2009; Steg, 2005) and encouraging people to shift from private cars to public transport (Mackett, 2001; Monzon et al., 2011; Redman et al., 2013; Rosli et al., 2012). As shown by today's high levels of car-use (64% of all UK trips; DfT, 2015) and increasing numbers of households with at least one car available<sup>1</sup>, however, this goal has not yet been met. With the battle to reduce car use far from won (Gärling & Schuitema, 2007; Graham-Rowe et al., 2011), it might seem unusual for us to ask, at this time, whether it is possible to move a subset of people away from using *buses*. However, there are actually good reasons to ask this question.

Certainly, in many circumstances, urban buses offer pollution and congestion advantages compared to private cars (Beaudoin et al., 2015; Kühne, 2010; Redman et al., 2013). As it happens, this advantage might be reversed at lower usage levels (Lowe et al., 2009; Walsh et al., 2008) meaning that, except when capacity is used efficiently, buses are not always a panacea. But that debate lies outside the focus of this paper. Here, we ask whether a subset of people might be persuaded off buses for other reasons. First, this could be useful in circumstances where bus operators are over peak capacity. Second, and more pressing, pollution and congestion problems are not the only problems surrounding urban transport. Readers of the *Journal of Transport and Health* will be aware that ill-health arising from physical inactivity is a pressing issue, in which the access to transit may play an important role (Troost et al., 2014), although not always as much as we might like. A study by Besser and Dannenberg (2005) showed that, despite transit users getting more exercise than car drivers (or non-transit users; see Saelens et al., 2014), only 29% met recommended levels of daily physical activity (i.e. 30 minutes or more) by walking to and from public transit alone. As the average length of a bus journey is 3.9 miles in the UK, and only 2.7 miles in London (Statista, 2015), there will be journeys at the lower end of the distribution that can feasibly be shifted to healthier (Audrey et al., 2014; Oja et al., 1998) and more sustainable alternatives – that is, walking and bicycling. This, in turn, could provide population health benefits (Jarrett et al., 2012) through addressing sedentary lifestyles (Varo et al., 2003) and associated health problems such as obesity and type 2 diabetes (Hu, 2011; Seidell, 2000). In fact, it has been estimated that increasing levels of active travel in urban England and Wales could reduce the prevalence of common diseases, such as diabetes or heart disease, to such an extent that it might reduce costs to the NHS by up to £17 billion (based on 2010 prices) within 20 years (Jarrett et al., 2012). Thus, given these population health issues and the fact that walking to transit alone does not qualify as a physical activity substitute for most public transport users (Besser & Dannenberg, 2005), mass transit use cannot be the only end-goal for travel behaviour change interventions. For some shorter trips, we might more appropriately view bus use as an intermediate goal between car use and active travel. Shaw and Gallent (1999) noted years ago that most bus trips tend to be sufficiently short to be substituted by green alternatives. Hence, it was always going to be

1 The UK saw a 14% increase in such households from 2001 to 2011 (Office for National Statistics, 2011).

necessary, sooner or later, to consider how a transition from public transport to active travel can be made for a certain subset of journeys in cities.

Furthermore, from the perspective of the individual traveller, there might be personal benefits from switching to more active forms of travel that they do not currently perceive. Recent evidence has repeatedly suggested that active commuters tend to be more satisfied with their journeys than drivers and, especially, public transport users (Olsson et al., 2013; St-Louis et al., 2014; Thomas & Walker, 2015). As such, there is an opportunity here for some bus users to better enjoy their daily commutes and, at the same time, to increase their level of physical activity in a way that is integral to their daily routine. We thus propose a way of identifying currently dissatisfied transit users who would be both healthier and happier if travelling actively, but who do not (just as some car drivers may objectively be better off using public transport but do not do so because they are trapped in their routines and unable to see alternatives; Anable, 2005).

To identify and target those users who may find a shift to active travel desirable, it is important to first recognize the individual variety in motives for bus use which may arise from a combination of internal (e.g. physical effort, socializing, cost) and/or external (i.e. situational) influences (e.g. availability and attractiveness of bus services; for the latter, see Stradling, 2002). This paper therefore provides a segmentation analysis focused on current bus users. Although we are not claiming to have identified a set of invariant bus user types, what we have done is demonstrate a replicable process for identifying potentially malleable subgroups of bus users. That said, it is interesting to note that the taxonomy we derived showed a significant overlap with more general travel segmentations, which suggests our taxonomy might be plausible more widely.

## 2. Method

### 2.1 Participants

Two-hundred and ninety-one staff members and students based at the University of Bath (see Figure 1; red circle) took part in an online survey (14<sup>th</sup> of May until 15<sup>th</sup> of June 2014) that was advertised on various noticeboards on campus as well as social media networks (Facebook and Twitter). As an incentive to take part, potential respondents were informed about the possibility to enter a prize draw for a £50 Amazon voucher after completing the survey. Of the 256 participants who completed the whole questionnaire (88%), 150 (58.5%) were female, 104 male (40.6%), and two respondents did not indicate their gender (0.9%). The age of respondents ranged from 18 to 65 ( $M = 26.2$ ,  $SD = 9.1$ ) and among respondents who indicated their student/occupation status ( $N = 254$ ), the majority followed an undergraduate degree ( $N = 118$ , 47%), followed by university staff members ( $N = 78$ , 31%) and postgraduates ( $N = 57$ , 22%). Eight respondents (3%) provided largely incomplete data (six respondents skipped the essential main part of the questionnaire and two filled in only the first half of this part) and a further 22 respondents (8.6%) missed at least one item. In both instances, responses were omitted from the main analysis (valid  $N$  listwise = 226). Of the remaining respondents, about one third reported living in the highly student populated area Oldfield Park ( $N = 72$ , 32%; blue circle), followed by locations outside of Bath ( $N = 28$ , 12%), the city centre ( $N$

= 27, 12%; green circle), and Bathwick ( $N = 16$ , 7%; yellow circle), all (except for locations outside of Bath) being within a three mile radius (network distance) of the university campus. None of the remaining locations ( $N = 83$ , 37%) accounted for more than 5% of the sample and were thus subsumed under “Other within Bath” (see Table 2).

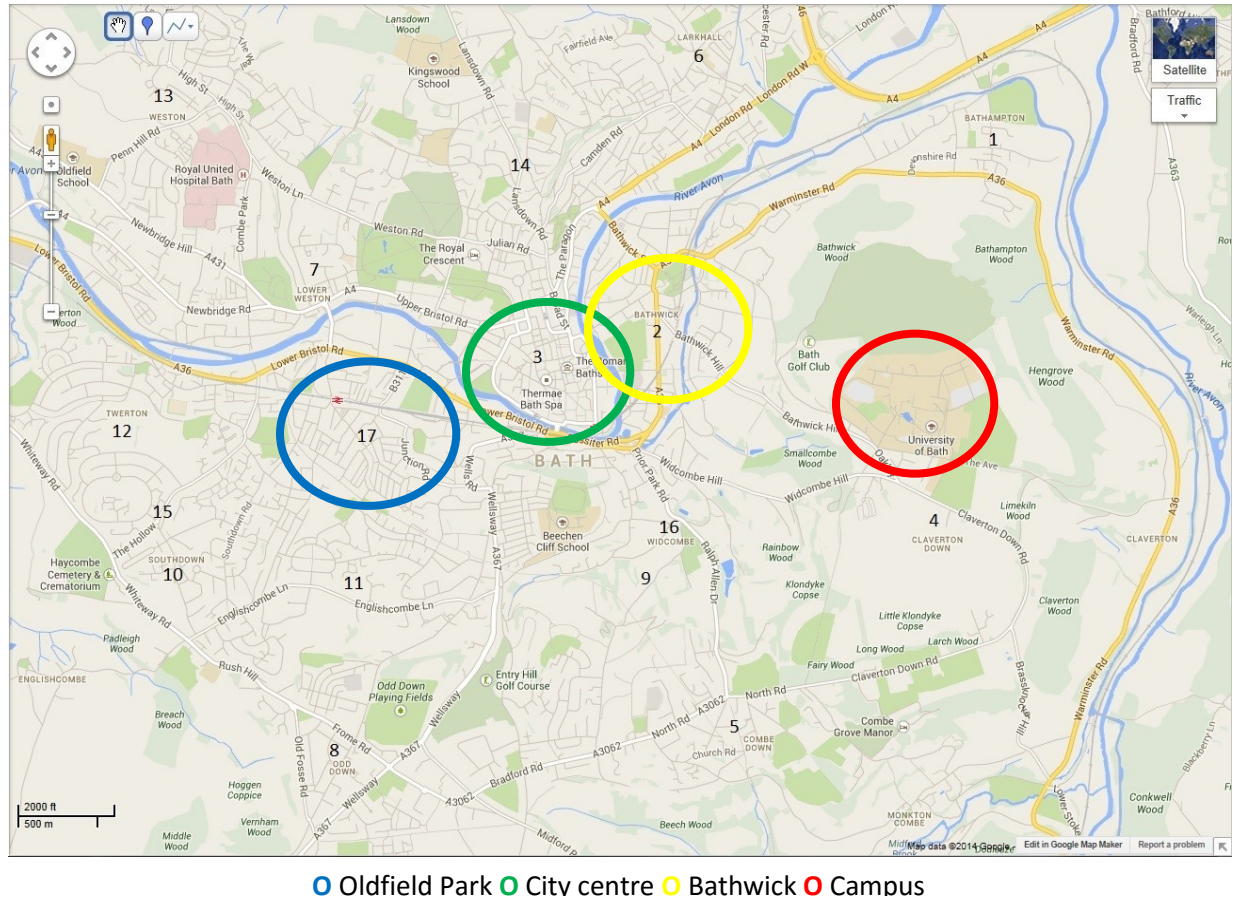


Figure 1. Local area map of the city of Bath as used in the survey (numbers 1-17 represent the different areas of Bath that participants were asked to choose their location from; added circles represent the main destination origins for bus travel to the university campus shown in red)

## 2.2. Materials

The online questionnaire was constructed using Qualtrics (2014) survey software and explicitly mentioned *familiarity* with the local bus services to campus as a participation requirement, defined as using the services at least once a week or having used them in the past. The survey consisted of five parts including:

- i) Information, participation requirements and informed consent
- ii) Demographic questions (age, gender, location, student/occupation status)
- iii) General travel related questions (main mode of travel, preferred bus company, bus use frequency and satisfaction)

- iv) For the central part of the questionnaire, we took 50 written statements on bus travel. These expressed a broad range of views about public transportation found in previous research (e.g. Beirão & Cabral, 2007; Gardner & Abraham, 2007; Jensen, 1999).

Thirty of the statements were taken from earlier focus groups and twenty were constructed by the researchers, in a matching style. Forty-two statements focused on bus travel to the university (e.g. “I hate being on the bus when it is packed”) and eight statements on other travel issues (e.g. “I do think Bath has a pollution problem”). All items were measured on a Likert-scale format ranging from 1 – Strongly disagree to 5 – Strongly agree. The full list of statements is shown in Table A1 in the appendix.

- v) A debriefing page.

### 3. Analysis & Results

#### *Factor analysis*

A principal component factor analysis (with varimax rotation) was carried out in SPSS Version 22 to reduce the 50 statements into an appropriate number of independent factors. Due to the relatively small sample size ( $N = 256$ ), the subject-to-variable ratio was low (5:1), yet fulfilled minimum requirements (Bryant & Yarnold, 1995). However, it should also be noted that according to Stevens (2009), the subject-to-variable ratio is less important than component saturation (i.e. the absolute magnitude of the loadings), the latter of which was in line with Guadagnoli and Velicers’ (1988) guidelines, as shown below. The absolute sample size was only fair, but sufficient according to a review by MacCallum, Widaman, Zhang and Hong (1999).

Inevitably, a drawback of data pre-processing in this way is that, by performing factor analysis prior to the clustering procedure, part of the distance information inherent in the original relationships (i.e. dependence) between the variables, which should be reflected in the clustering solution, becomes lost (Dolnicar, 2002). On the other hand, interpreting a cluster solution based on the 50 questionnaire statements would hardly be feasible, thus rendering some data pre-processing necessary. Variables with loadings  $> |.40|$  were considered part of a factor. Following the guidelines of Guadagnoli and Velicer (1988), a factor was considered to be reliable when it showed four or more loadings with an average value  $> |.60|$  (regardless of  $N$ ) or 10 or more loadings  $> |.40|$  with  $N > 150$ .

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (Kaiser, 1970) was in the middling range (.75), thus justifying the use of factor analysis for the current sample. Likewise, Bartlett’s test of sphericity (Bartlett, 1950), which tests the assumption that the sample correlation matrix stems ‘from a multivariate normal population in which the variables of interest are independent’ (Dziuban & Shirkey, 1974, p. 358), was significant ( $X^2 = 3726$ ,  $df = 1225$ ,  $p < .001$ ), although the probability of rejection of the hypothesis increases with sample size. In total, 16 factors with eigenvalues equal to or greater than 1.00 were extracted and these factors together accounted for approximately 65% of explained variance. Inspection of the rotated factor solution suggested the presence of four reliable factors, each with at least



four variables with an average loading of at least .60 (Guadagnoli & Velicer, 1988) and acceptable levels of reliability as indicated by Cronbach's alpha of .70 or higher. Table 1 provides summary data for the first four factors.

### *Cluster analysis*

In this step, using the four factors described above, respondents were grouped together using a hierarchical clustering algorithm (Ward's method, 1963) with squared Euclidean distance as the similarity measure. The latter was chosen because it puts an increasingly higher weight on objects as the distance between them increases (i.e. it maximises the distance between groups; Burns & Burns, 2008). A look at the coefficients in the agglomeration schedule suggested a three-cluster solution, as subsequent agglomerations of dissimilar clusters only produced small step changes in the agglomeration schedule. However, inspection of the dendrogram produced by Ward's (1963) method suggested that the three initial clusters could be further divided into six clusters (circles) while maintaining a sufficient degree of distinctiveness. Consequently, in the next step, three and six clusters were chosen for extraction with the k-means clustering procedure (e.g. Faber, 1994; Jain, 2010; Punj & Stewart, 1983), of which the six cluster solution appeared to provide the better trade-off between differentiation and interpretability of clusters. The resulting clusters were then compared against demographic and travel-related information for ease of interpretation.

Figure 2 shows the mean scores for the people in each cluster on the four bus-attitude measures extracted from the factor analysis. As can be seen from the graphic, the six clusters of users differ clearly across the four measures, and a detailed interpretation of this is offered below. Demographic information and descriptive statistics for each of the clusters is presented in Figure 3 and Table 2. Notably, members of clusters with a frequency of bus trips in a typical week reaching eight trips or more (Clusters 3 and 4) also reported being significantly more satisfied than the remaining clusters (except Cluster 1). Cluster 6, however, stood out from the analysis by having the highest weekly trip frequency overall, yet also by having one of the lowest satisfaction ratings. A possible explanation for this finding is the high proportion of Company 2 bus services users in this cluster (50%), as Company 2 bus users ( $M = 3.9$ ,  $SD = 1.6$ ) were significantly less satisfied on average than Company 1 bus users ( $M = 4.6$ ,  $SD = 1.5$ ) with  $M_{diff} = .7$ ,  $p = .02$ , 95% CI [.1, 1.2], although they did not differ from those using a combination of services ( $M = 4.1$ ,  $SD = 1.4$ ) with  $M_{diff} = .2$ ,  $p = 1$ , 95% CI [-.8, .5].

Factor	Example attitude statement (variable loading most highly on the factor)	Number of variables loading on factor	Cronbach's alpha	% of Variance
<i>Unreliability</i>	<p>"The buses are not reliable on their schedules. I think it [the bus] is not...it's later or earlier, but never on time." (.72)</p> <p>"It's really horrendous. You can end up queuing for a long time and don't get a seat." (.70)</p> <p>"The bus company keeps saying that their service is running normally, but everybody knows that it doesn't." (.64)</p> <p>"I don't have any problems with delays." (-.60)</p> <p>"Sometimes you're standing in the cold and rain and are waiting...not for the buses to come, but for the buses actually to stop, which is really annoying." (.59)</p> <p>"At certain times of the day I find the buses really awful." (.57)</p> <p>"Waiting/Queuing for the bus is frustrating and annoying." (.55)</p> <p>"There's 'a leaky pipeline in terms of communication' between the bus company and its customers." (.55)</p> <p>"Even though the buses are expensive, I think I wouldn't mind so much if I knew that I could get to a bus stop and get on a bus within like ten minutes or so. That'd be okay. But if you end up waiting ages and paying a lot, that's when the price becomes questionable." (.52)</p>	9	.83	8.7
<i>Pro-bus</i>	<p>"Being on the bus allows me to relax." (.77)</p> <p>"Actually, I like being on the bus." (.65)</p> <p>"It's comfortable to get the bus." (.57)</p>	7	.76	6.1
<i>Pro-walking</i>	<p>"I don't know, [when you walk] you just get more awake to your lectures, whatever it is that you need to do. When you walk back, you just kind of...it allows you to relax and leave everything like back here at Uni. And by the time you get home, you're like...just home and enjoy." (.78)</p> <p>"If there was no bus service, I would walk up to Uni." (.73)</p> <p>"Going down, I think, there's really not much reason to get the bus." (.59)</p>	6	.70	5.5
<i>Convenience/habit</i>	<p>"I almost always take the bus to university. It's a habit." (.74)</p> <p>"I get the bus because it is the most convenient choice for me (for instance, because the next bus stop is very close)." (.72)</p> <p>"After you start taking the bus, it's harder to quit." (.57)</p> <p>"When I just want to get home or it's raining very hard, I take the bus." (.55)</p>	5	.70	5.4

Table 1. Summary of the rotated factor solution showing all factor loadings > |.50|



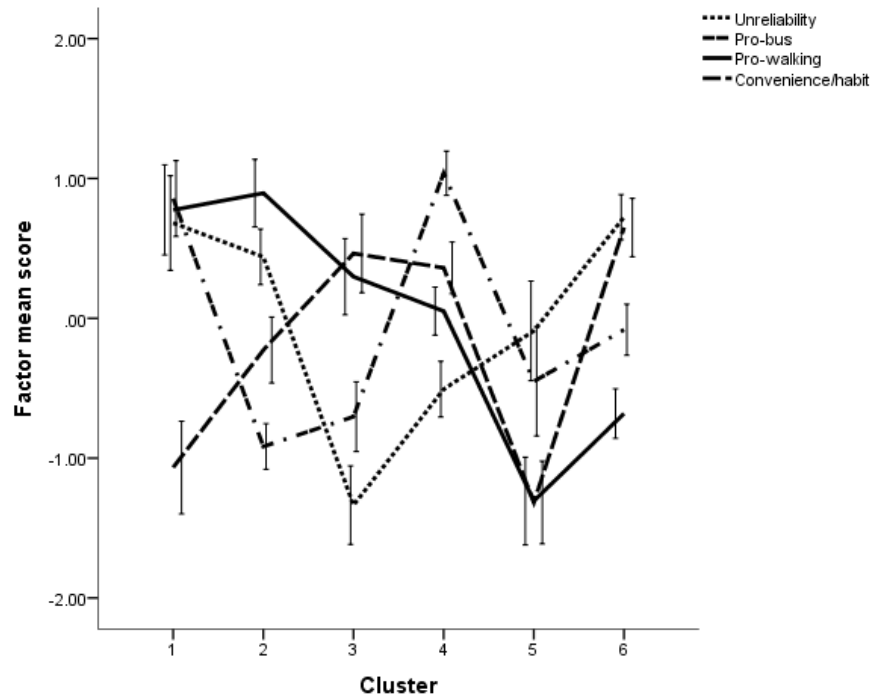


Figure 2. Mean factor scores by cluster (error bars: 95% CI)

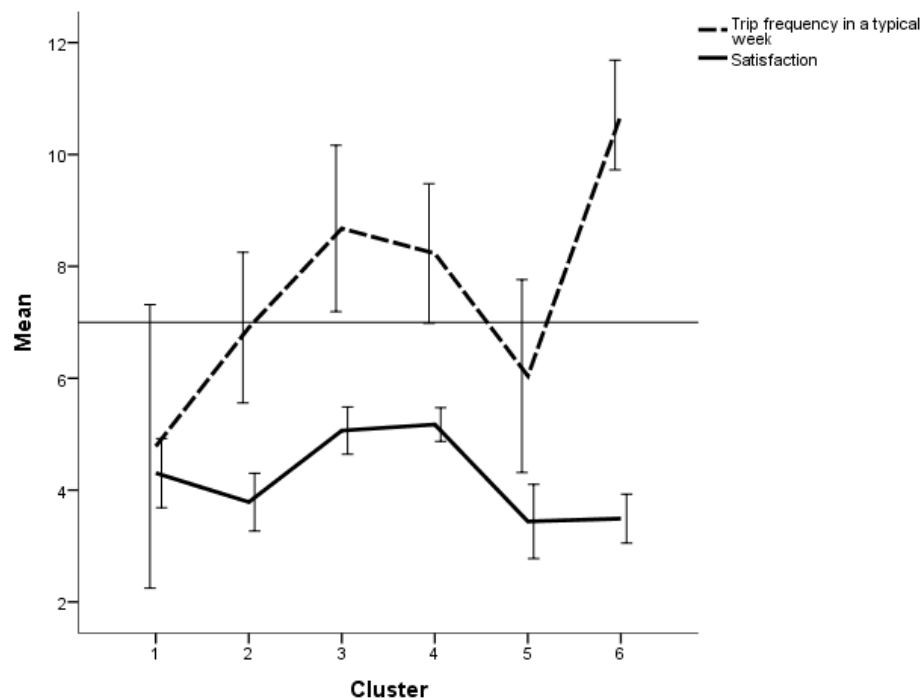


Figure 3. Self-reported trip frequency (journneys per week) and satisfaction ratings (rated on a scale ranging from 1 – Very dissatisfied to 7 – Very satisfied) by cluster (error bars: 95% CI)

<i>Demographics</i>	<i>Cluster 1</i>	<i>Cluster 2</i>	<i>Cluster 3</i>	<i>Cluster 4</i>	<i>Cluster 5</i>	<i>Cluster 6</i>
<i>Total N</i>	<i>N = 23</i>	<i>N = 42</i>	<i>N = 31</i>	<i>N = 54</i>	<i>N = 25</i>	<i>N = 51</i>
<i>Male</i>	<b>57%</b>	36%	26%	30%	<b>60%</b>	47%
<i>Female</i>	43%	<b>64%</b>	<b>74%</b>	<b>70%</b>	40%	<b>53%</b>
<i>Mean age</i>	28.4	26.4	24	25	<b>30</b>	25.7
<b><i>Student/occupation</i></b>						
<i>Undergraduate</i>	<b>39%</b>	<b>45%</b>	<b>61%</b>	<b>52%</b>	36%	<b>51%</b>
<i>Postgraduate</i>	30.5%	19%	13%	28%	20%	18%
<i>University staff</i>	30.5%	36%	26%	20%	<b>44%</b>	29%
<b><i>Main mode</i></b>						
<i>Bus</i>	26%	<b>67%</b>	<b>77%</b>	<b>74%</b>	<b>52%</b>	<b>88%</b>
<i>Bicycle/motorcycle</i>	22%	2%	3%	4%	-	-
<i>Car/car passenger</i>	9%/-	5%/-	3%/3%	7%/-	36%/4%	2%/-
<i>Train</i>	4%	7%	3%	7%	4%	10%
<i>Walk</i>	<b>39%</b>	19%	10%	7%	4%	-
<b><i>Location (network dist.)</i></b>						
<u><i>Areas within 2 miles (3.2km)</i></u>						
<i>Bathwick (1.4m, 2.2km)</i>	26%	5%	3%	6%	4%	6%
<i>City centre (1.7m, 2.7km)</i>	4%	19%	10%	15%	8%	10%
<u><i>Areas between 2 to 4 miles (3.2 - 6.4km)</i></u>						
<i>(Lower) Oldfield Park/ Moorland Rd (2.8m, 4.5km)</i>	13%	26%	39%	<b>35%</b>	20%	<b>43%</b>
<i>Other locations within Bath (1.3 - 3.8m, 2.1 - 6.1km)</i>	<b>48%</b>	<b>38%</b>	<b>45%</b>	31%	<b>40%</b>	29%
<u><i>Other locations outside Bath (5.2 - 39m, 8.4 - 62.8km)</i></u>	9%	12%	3%	13%	28%	12%
<b><i>Preferred bus company</i></b>						
<i>Company 1</i>	<b>39%</b>	36%	<b>48%</b>	<b>50%</b>	32%	25%
<i>Company 2</i>	30.5%	<b>38%</b>	39%	30%	32%	<b>50%</b>
<i>Combination/Company 3</i>	30.5%/-	24%/2%	13%/-	20%/-	<b>36%/-</b>	25%/-
<b><i>Mean trip frequency</i></b>	4.8	6.9	8.7	8.2	6	<b>10.7</b>
<b><i>Mean satisfaction</i></b>	4.3	3.8	<b>5.1</b>	<b>5.1</b>	3.4	3.5

Table 2. Cluster demographics (highest values in bold)

### Cluster descriptions

Overall, the six segments differed markedly in the number of bus trips during a typical week, which ranged from a mean of 4.8 to 10.7 weekly journeys ( $M = 7.9$ ,  $SD = 4.7$ ), thus representing both high- and low-frequency users. Even stronger (and significant) differences were observed for satisfaction (see Figure 5), with clusters 3 and 4 being more satisfied (all  $p < .001$ ) than the remaining clusters (except cluster 1). Now, to make the information in Table 2 more accessible, we present short subjective 'biographies' of the six types of bus user identified here. These provide useful communication about the user groups, at the expense of removing some of the subtleties in Table 2.

**Cluster 1 – *Mode mixers*.** Survey respondents in the smallest of the six clusters ( $N = 23$ ) were dissatisfied with the unreliability of the buses and expressed a favourable attitude towards alternative travel modes, particularly walking. In line with this, they reported the lowest bus trip frequency in a typical week ( $M = 4.8$ ), which is still significantly higher than the national trip average of little more than one trip per week (based on 60 bus trips per year; DfT, 2015). However, despite being dissatisfied with the reliability of the bus service, mode mixers held a surprisingly positive attitude regarding the experience of being on the bus. About three fifths of the respondents in this cluster reported either walking (39%) or cycling (22%) to campus as their main mode of travel.

**Cluster 2 – *Wannabe Walkers*.** Like members of the first cluster, respondents in this female-dominated group (64%) showed some degree of dissatisfaction with the reliability of service and a preference for alternative travel modes. However, unlike members of the first cluster, who were happy with the on-bus experience, Wannabe Walkers did not like the experience of being on the bus at all, but paradoxically used the bus fairly regularly ( $M = 6.9$  trips/week). As the label implies, these bus users would like to forsake the bus in favour of walking (as indicated by their high pro-walking score; see Figure 2) but may feel constrained in their choice, preventing change.

**Cluster 3 – *All Fine on the Weston Front*.** The third and youngest cluster ( $M = 24$ ) was also dominated by female respondents (74%) and largely represented undergraduate students (61%). They predominantly lived in outlying areas of the city such as Weston and Oldfield Park. In contrast to the first two clusters, members of this group did not perceive any difficulties with the reliability of bus services, although they did not like the experience of being on the bus. They showed a high trip frequency in a typical week ( $M = 8.7$ ) and were quite satisfied with the service in general ( $M = 5.1$ ). Despite holding a slightly positive attitude regarding walking, members of this cluster do not appear to have a strong desire for a change in travel mode.

**Cluster 4 – *First Fans*.** Dominated by undergraduate students (52%) and female respondents (70%), about one third (35%) of people in this cluster reported living in the highly student-populated area Oldfield Park. Showing similar trip frequency and satisfaction ratings to the third cluster ( $M = 8.2$  and  $M = 5.1$ , respectively), respondents in this fourth cluster did not perceive a need to change travel mode. In particular, members of this cluster were content with the reliability of the service (albeit to a lesser extent than members of the third cluster) and, among all groups, held the most favourable attitude concerning bus travel. Half of the bus

users in this cluster preferred Company 1 which, as mentioned before, received the highest satisfaction ratings overall.

Cluster 5 – *Car Curtailed*. As one of the only two male-dominated clusters (60%), and as the second-smallest cluster ( $N = 25$ ), this group featured a high occurrence of university staff (44%) and car drivers (36%). This cluster also had the highest mean age ( $M = 30$ ). Showing a moderate trip frequency ( $M = 6$  trips/week) and the lowest bus-satisfaction rating ( $M = 3.4$ ), members of this cluster held a negative attitude toward both the bus and walking. In fact, they reported by far the most unfavourable attitude to walking as a potential alternative mode of travel, in part due to longer distances being travelled (28% lived outside of Bath). Instead, members of this cluster appear to favour private motorized transport and to rely on the buses only if they have to. The affordability of a car may pose an obstacle for the non-car owners in this cluster.

Cluster 6 – *Daily Drags*. About half of the bus users in this cluster preferred Company 2 (49%) which, as mentioned above, generally received lower satisfaction ratings than the rival Company 1. Largely representing undergraduate students (51%), the majority of respondents in this cluster lived in the highly student-populated area of Oldfield Park (43%) and were most dissatisfied with the reliability of the bus service. Members of this cluster showed by far the highest trip frequency in a typical week ( $M = 10.7$ ) and were equally dissatisfied as members of the fifth ('Car curtailed') cluster ( $M = 3.5$ ). In addition, most individuals in this cluster were not very favourable towards walking as an alternative to using the bus, albeit not as negative as the Car Curtailed users (see Figure 2).

#### 4. Discussion

Earlier travel market segmentation schemes have focused on drivers (e.g. Anable, 2005; Gardner & Abraham, 2007; Jensen, 1999), bicyclists (Bergstrom & Magnusson, 2003; Li et al., 2013) or, alternatively, have taken a broader approach incorporating several or no specific travel modes (Bösehans & Walker, in preparation; Diana & Mokhtarian, 2009; Jacques et al., 2013). However, little empirical segmentation work has been carried out focusing exclusively on the public transport user. And even in cases where such research has been carried out (see, for instance, Beirão & Cabral's, 2008, or Krizek & El-Geneidy's, 2007, research on transit users; or Tarigan et al.'s, 2014, research on paratransit users in Indonesia), the focus has usually been on identifying service factors that may *increase* the attractiveness of public transport to current non-users or potential users, rather than on encouraging a subset of users, whose journeys are sufficiently short, to use alternatives. The research presented thus addresses a gap in the literature by focusing exclusively on bus users' experiences, not with the goal to increase bus ridership (e.g. Redman et al., 2013), but with the goal to determine the factors that may motivate people to change their travel behaviour (e.g. by increasing their multi-modality or through a change in travel mode) and to identify any sub-types of bus users with a high propensity to do so. The results suggested that six types of bus user can be distinguished. Although factors such as main mode, location and preferred bus company played a role, the segments differed most clearly in terms of trip frequency and satisfaction. The latter point is

likely to be particularly important if our goal is indeed to move some people from the bus to more active and sustainable modes of travel.

Importantly, the segments showed some degree of overlap with earlier travel market segmentations that included public transport users. In particular, the three bus user types (Convenience, heart and necessity) identified by Jensen (1999) reappeared in some form here, as did the almost obligatory segment of dedicated car drivers (Anable, 2005; Jensen, 1999), who have a strong aversion against public transport and only use those services if they have to. For instance, Jensen's (1999) Public transport users of convenience were also found in the present sample (*'All fine on the Weston front'*), a finding that aligns with previous research which has found practical considerations, rather than comfort, as driving the choice of public transport for some users (Rubens et al., 2011). Similarly, Public transport users of heart (Jensen, 1999) or Transit Enthusiasts (Beirão & Cabral, 2008), who may be seen as belonging to Jacques et al.'s (2013) 'Dedication' cluster (i.e. enjoyment-focused despite eventual costs in terms of practicality), were reflected in the *'First fan'* cluster here. On average, these users scored highest on the Pro-bus factor which included items such as "Being on the bus allows me to relax" or "It's comfortable to get the bus". Being able to relax, rest or read has been shown to be a potential advantage of using public transport compared to the private car (Beirão & Cabral, 2007), although it is not clear whether these users actively look for these properties when choosing public transport as their travel mode or whether it is more of a pleasant side-effect. Either way, both of the aforementioned clusters may have little desire to switch to more active forms of travel because they either value the convenience of taking the bus over the relatively more effortful alternatives of walking or cycling (*'All fine on the Weston front'*), or because they genuinely enjoy the experience of traveling by bus (*'First fan'*).

Finally, Public transport users of necessity (Jensen, 1999) were represented in the *'Daily drag'* cluster. Deeply dissatisfied with the unreliability of bus services, these captive and strongly habitual users felt a lack of control and flexibility which is generally associated with the use of public transportation (Beirão & Cabral, 2007; Thomas et al., 2014). Although not particularly in favour of walking as an alternative (low score on the Pro-Walking factor), these users, at a minimum, have a motivation to switch to alternative forms of transport. In contrast, bus users in the Car-curtailed cluster, analogous to Beirão and Cabral's (2008) Obstinate drivers, only use the bus rarely and only if they have to. They may prefer the freedom, independence and prestige that the car offers (Anable, 2005; Beirão & Cabral, 2007; Jensen, 1999; Steg, 2005; Thomas et al., 2014) and, consequently, may represent a group of 'Die hard drivers' or 'Complacent car addicts' (Anable, 2005) rather than a cluster of regular bus users. As a result, they may be rather unlikely to either commit to public transport or to engage in active travel in the future.

Whereas these clusters strongly resembled earlier segmentation research, the present study has also led to the identification of two further distinguishable groups. The somewhat dissatisfied *Wannabe Walkers*, whose aim it is to rely on the bus less or to abandon the bus entirely, might also be described as 'Malcontented bus users' analogous to Anable's (2005) 'Malcontented drivers'. They have a profound desire to engage in more active and sustainable travel and thus might be particularly receptive to any interventions supporting such change.

*Mode Mixers*, on the other hand, rely on the bus merely some of the time since they are already using alternative modes of travel, such as walking or cycling, most of the time. Although the current study did not allow a further exploration of these users' motives, it can be assumed that journey-based affect is relatively high for these modes, as has been illustrated in past research (LaJeunesse & Rodríguez, 2012).

#### 4.1 Strengths and limitations

As it is based on a case study in a particular environment, the taxonomy of bus users that we provide is not necessarily definitively representative of the wider population of bus users. Although a fairly representative distinction of students and staff members using the bus *to and from the University of Bath* has been achieved, new or different clusters might emerge in other settings. Some of the 50 statements on bus travel and alternatives, which provided the foundation for the main analysis, contained information on the local context (e.g. about the steep hill leading to university), meaning the findings might not be directly applicable to other settings. For instance, research conducted by Parkin et al. (2008) has shown that hilliness of the environment is the major physical factor predicting cycling to work. It is likely that, in an environment where cycling is more attractive (e.g. Cambridge), the balance between clusters may shift (e.g. more *Mode Mixers*) or even that new clusters may arise. Consequently, to determine the external validity of the clusters, the unique features of the environment (topography, street architecture etc.) and of the local bus services (i.e. cost, frequency, reliability, quality of buses etc.) in other cities need to be considered (e.g. Farag & Lyons, 2012), eventually resulting in nuances to the current cluster solution. As a consequence, being aware of the contextual limitations of the present study, our goal was to demonstrate a replicable *process* of segmentation which illustrates that targetable groups of transit users can be identified. That is, our aim did not consist of definitively identifying global invariant bus user segments and, as such, the issue of generalization may not necessarily be a deficit.

Relatedly, travel distance is another factor that deserves mention, as with increasing distance, the likelihood of people switching from public transport to active travel is, in all likelihood, going to decrease. According to Millward et al. (2013), travel-to-work trips by foot are uncommon and the usual distance travelled by walking only rarely exceeds two kilometres. Consequently, not all trips in the current sample may be feasibly shifted to walking. Cycling may be an alternative for trips exceeding two kilometres in length, but attitudes towards cycling were not measured in the present study. Yet these specifics notwithstanding, the more general point of interest here is that there will often be a subset of journeys that can feasibly be changed to active modes, if we search for these.

In theory, it could be argued that encouraging shifts from public transport to active travel might reduce revenue on the buses which could lead to some routes becoming commercially unviable, ultimately leading to their abandonment. A possible concern arising from this might be that some bus users who have previously been walking for part of their trip, may now switch to using the car which, in turn, would counteract the objective of encouraging active and sustainable travel and could even lead to a net decrease in physical activity and an increase in emissions. As we have outlined in the introduction, however, we are not considering

a situation whereby buses are emptied and routes made non-viable; let alone would we expect travel mode shifts in that magnitude to occur. We are considering a situation where high-demand buses, especially during peak times, may have their capacity stabilised by removing people who might be happier not using the bus, thereby freeing capacity for people who would like to use it.

It has to be said that the current study only included a small sample of student and staff bus users, representing approximately 2.5% of all people having used the bus services to our campus on at least one occasion (calculated based on 2014 traffic count data), whose bus use experiences may also differ from the experiences of other people who are not commuting to the university. In particular, due to the university context, the survey is over-representing young and middle-aged adults, while neglecting other, especially older, age groups. In terms of gender, a higher female proportion of bus users was obtained (58.5%), in line with national figures that indicate a higher bus use by women in all age groups (DfT, 2013). More specifically, national figures suggest that 56.5% of all bus trips are undertaken by women, with the largest differences in proportions being observed among younger (17-20: 60% female) and older bus users (60-69: 60.4% female). According to the University of Bath's 2014 travel survey, more than every second commute (55%) to campus is by bus, a far higher proportion than the national average that ranges from 5% to 11% for journeys under two miles and two to five miles, respectively (DfT, 2014). This may limit the external validity of the present cluster solution, yet also highlights the need for further research in this area. In addition, responses were only collected near the end of term time which could have had an impact on the results due to fluctuations in bus use throughout the academic year (e.g. less students may use the bus during exam periods).

Overall, however, the strong overlap with earlier segmentation studies suggests that these limitations did not have a strong impact on the results. In addition, the internal validity of the cluster solution may be assumed to be strong because the sample population was highly homogenous regarding its trip purpose (commute to campus), thus avoiding potential confounds in these respects. Finally, trip lengths mirrored the national average (3.9 miles; Statista, 2015) with 88% of trips being under four miles, suggesting that the results may be transferable to the wider population of bus users.

## 4.2 Implications

The identification of different types of bus users has important implications for our general understanding of the public transport user and the encouragement of active travel. In the current sample, 88% of bus users lived within a four mile radius of the university campus, supporting the notion that bus trips can be sufficiently short to be undertaken by either walking or cycling (Shaw & Gallent, 1999).

First, overall the results lend support to earlier research (Beirão & Cabral, 2008, 2009; Jensen, 1999) distinguishing public transport users beyond an oversimplified captive versus choice user distinction. Second, in terms of healthy and sustainable travel, the segmentation has illustrated how subgroups of current transit users, which may be particularly amenable to interventions promoting and encouraging alternatives to public transport usage, can be



identified. The Wannabe Walkers, representing 19% of this sample, expressed a strong desire for more active travel (walking) and thus may be a primary target for interventions. The dissatisfied Daily Drags (22% of the sample), on the other hand, did not regard walking as a desirable alternative, but may be open to other alternatives, such as cycling or car-sharing, although this was not measured in the present study. Reinforcing perceived behavioural control in these groups – for instance, through personalised travel planning interventions (Graham-Rowe et al., 2011) or targeted information provision (López-Sáez et al., 2016) – may help them to bridge the gap between their current state and the desirable behaviour (i.e. walking or bicycling). Behaviour change may be most effectively encouraged during stages of transition or life events (Verplanken et al., 2008), such as a relocation to a new home (Verplanken & Roy, 2016), although the window of opportunity may be short (Walker et al., 2014). Third, the cluster information found here can be used by bus companies to address the concerns of the most dissatisfied users (Car Curtailed or Daily Drags) and, subsequently, to improve their services to attract new regular customers (e.g. Car Curtailed users abandoning their car) and increase satisfaction for existing customers (e.g. by improving the waiting experience; Friman, 2010), who might otherwise be drawn to the even more environmentally harmful alternative of car travel (Daily Drags).

#### 4.3 Future research

Due to the novel approach taken in the current study, we would welcome any direct or conceptual replications of the current findings. Future research efforts could consolidate and extend the current results by testing the proposed distinction of public transport (bus) users through an application of the questionnaire statements used in this study. Ideally, any context-dependent items would be replaced and any future replication attempts would be conducted with a larger, more varied, sample; in different types of physical environment (e.g. flat versus hilly local topography); and various types of contexts (e.g. work versus leisure destinations, good versus bad public transport service). Also, the generalizability to other public transport modes, such as the train or Underground, may be examined. Finally, although the present study has identified potential target groups for encouraging healthy and (more) sustainable travel among current public transport users, the question as to how best to encourage a corresponding shift needs further investigation. A promising option may be to stress the autonomy that is gained by travelling actively (Thomas et al., 2014).

## 5. Conclusion

Whilst we certainly view buses as important and more desirable than the private car for many urban journeys, and see great value in work to shift journeys from car to bus, this does not preclude a parallel stream of work, beginning here, which asks whether there might be a subset of people whose bus journeys are sufficiently short that they would be healthier and more satisfying if made through active modes. The present study has offered insight into the motivations and experiences of different kinds of bus users and has highlighted commonalities to earlier segments found in previous research. If the estimates produced here generalize, the implication would be that approximately 19-41% of bus users might be willing to switch to

other modes. Although public transport may be regarded as an already fairly sustainable means of transport, dissatisfied regular bus users should be encouraged to travel more actively and sustainably, if possible, and the data provided here should also help service providers improve the quality of public transport. Although a mode shift may not be feasible or desirable for every individual user, some groups of bus users (in this case, the *Wannabe Walkers*), may be targeted by tailored campaigns and interventions in the future, providing an opportunity for improvements in both population health and environmental quality.

#### 5.1 Conflict of Interest

The authors declare no conflict of interest.

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## Appendix

Questionnaire statements		N	Mean	SD
1.	"It would be convenient to be able to get on any service with one's bus pass."	250	4.57	.74
2.	"At certain times of the day I find the buses really awful." (FG)	250	4.33	.93
3.	"You have to be really fit in order to cycle up that hill."	248	4.23	.95
4.	"I hate being on the bus when it's packed." (FG)	248	4.21	.89
5.	"Even though the buses are expensive, I think I wouldn't mind so much if I knew that I could get to a bus stop and get on a bus within like ten minutes or so. That'd be okay. But if you wind up waiting ages and paying a lot, that's when the price becomes questionable." (FG)	250	4.20	.94
6.	"Waiting/Queuing for the bus is frustrating and annoying." (FG)	249	4.11	.93
7.	"The daily commute is not exactly something that you look forward to or enjoy; it's just something that's there."	247	4.00	.82
8.	"When I just want to get home or it's raining very hard, I take the bus." (FG)	248	3.98	1.04
9.	"Being able to get on the bus doesn't just depend on the point of time of the day or the weekday as such. It also depends on where you are trying to get on the bus, which is unfair." (FG)	248	3.97	.98
10.	"Sometimes you're standing in the cold and rain and are waiting...not for the buses to come, but for the buses actually to stop, which is really annoying." (FG)	248	3.97	.97
11.	"The bus company keeps saying that their service is running normally, but everybody knows that it doesn't." (FG)	248	3.86	.93
12.	"There's 'a leaky pipeline in terms of communication' between the bus company and its customers." (FG)	246	3.84	.879
13.	"The buses are not reliable on their schedules. I think [the bus] is not...it's late or earlier, but never on time." (FG)	250	3.83	1.04
14.	"When I'm on the bus, I just let my mind wander." (FG)	248	3.81	.76
15.	"It's really horrendous. You can end up queuing for a long time and don't get a seat." (FG)	250	3.73	1.09
16.	"If I don't get a seat and I'm standing, then I don't do anything." (FG)	250	3.68	.95
17.	"Buses are hot and sweaty."	246	3.65	.86
18.	"For me, using the bus is really an average experience. I don't find it terrible, but I don't find it great either. It gets you from A to B." (FG)	250	3.62	.98
19.	"I almost always take the bus to university. It's a habit."	250	3.54	1.33
20.	"I get the bus because it is the most convenient choice for me (for instance, because the next bus stop is very close)."	248	3.54	1.05
21.	"Most of the bus drivers are quite nice." (FG)	247	3.50	1.02
22.	"Commuting time on the bus really is wasted time for me."	246	3.45	1.02
23.	"Sometimes you take more time to take the bus than when you run up." (FG)	250	3.44	1.18
24.	"I think it [the bus] is quite expensive. It just feels like such a rip-off." (FG)	250	3.38	1.10

25. "I don't know, [when you walk] you just get more awake to your lectures, whatever it is that you need to do. When you walk back, you just kind of...it allows you to relax and leave everything like back here at Uni. And by the time you get home, you're like really relaxed...just like home and enjoy. Plus, the fresh air helps just to calm down." (FG)	248	3.34	1.08
26. "If I could drive, I'd do that instead of getting the bus."	248	3.33	1.39
27. "If there was no bus service, I would walk up to Uni." (FG)	249	3.31	1.31
28. "I can't get home fast anyways because I'd have to queue. So, I can as well spend the time by doing something nice or useful, such as talking to friends/colleagues or studying." (FG)	248	3.29	.85
29. "When on the bus, I'm usually busy with my smartphone (other than simply listening to music)."	250	3.28	1.14
30. "The quality of the buses is good."	249	3.15	1.04
31. "They [the local bus services] have got better over the years." (FG)	247	3.14	.80
32. "It's easy to find information about bus routes, fares and timetables."	250	3.10	1.20
33. "After you start taking the bus, it's harder to quit." (FG)	248	3.10	1.08
34. "I often chat with friends or colleagues on the bus."	249	3.09	1.17
35. "Taking the bus is the easiest way to save your time and energy." (FG)	248	3.07	1.05
36. "I usually listen to music on the bus."	249	3.04	1.41
37. "Being on the bus is depressing and tiring."	248	3.02	.98
38. "It's comfortable to get the bus." (FG)	247	3.01	.94
39. "I do think Bath has a pollution problem." (FG)	248	3.00	1.04
40. "Going down, I think, there's really not much reason to get the bus." (FG)	250	2.94	1.12
41. "There's nothing social about bus rides." (FG)	248	2.93	1.07
42. "To walk up that hill...I don't know how people do it. It's hard." (FG)	247	2.91	1.32
43. "Getting the bus makes me feel good in terms of environment." (FG)	248	2.89	.95
44. "Being on the bus allows me to relax."	250	2.74	1.04
45. "Actually, I like being on the bus."	248	2.63	1.00
46. "I prefer to read when I'm on the bus."	249	2.58	1.19
47. "I can't think of any good aspects of the bus services here." (FG)	250	2.39	1.05
48. "The main reason I take the bus is because everyone else does."	247	2.24	1.09
49. "I have never thought about using alternatives to the bus."	249	2.22	1.10
50. "I don't have any problems with delays."	247	1.79	.84

*Table A1. Statement means and standard deviations (FG = focus group statement)*